CLAIMS

1. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
means for moving the second conductive member relative the first conductive member.

2. The antifuse structure of claim 1, wherein the means for moving the second conductive member comprises a material composition including a gas in solid solution.

3. The antifuse structure of claim 1, wherein the means for moving the second conductive member comprises a material composition including hydrogen in solid solution or in a hydride phase.

4. The antifuse structure of claim 1, wherein the means for moving the second conductive member comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in a hydride phase.

5. The antifuse structure of claim 1, wherein the means for moving the second conductive member comprises a thin-film resistor and a layer comprising at least one of the following compounds: Pb_3O_4, PbO_2, HgO, Ag_2O, MnO_2, Ag_2O, K_3N, Rb_3N, $ReN_{0.43}$, Co_3N, Ni_3N, or Cd_3N_2.

6. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
a layer comprising a gas in solid solution or a hydride phase adjacent to one of the first and second noncontacting conductive members.

7. The antifuse structure of claim 6, wherein the layer comprises a material composition including hydrogen in solid solution or in a hydride phase.

8. The antifuse structure of claim 6, wherein the layer comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in a hydride phase.

9. The antifuse structure of claim 6, wherein the first noncontacting conductive member lies at least partly between the layer comprising the gas in solid solution or hydride phase and the second noncontacting conductive member.

10. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
a layer comprising a gas in solid solution or hydride phase for moving the second conductive member relative the first conductive member.

11. The antifuse structure of claim 10, wherein the layer comprises a material composition including hydrogen in solid solution or in a hydride phase.

12. The antifuse structure of claim 10, wherein the layer comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in a hydride phase.

13. The antifuse structure of claim 10, wherein the first noncontacting conductive member lies at least partly between the layer comprising the gas in solid solution or hydride phase and the second noncontacting conductive member.

14. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
a layer adjacent to one of the first and second noncontacting conductive members and comprising at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in a hydride phase.

15. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
a layer adjacent to one of the first and second noncontacting conductive members and comprising at least one of a metal hydride, Pb_3O_4, PbO_2, HgO, Ag_2O, MnO_2, Ag_2O, K_3N, Rb_3N, $ReN_{0.43}$, Co_3N, Ni_3N, Cd_3N_2 or a compound which can be charged with hydrogen, oxygen or nitrogen to yield one of these compounds.

16. An antifuse structure in an integrated circuit, comprising:
first and second noncontacting conductive members; and
a layer adjacent to the second noncontacting conductive members for moving the second conductive member into contact with the first conductive member, the layer comprising at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in a hydride phase.

17. An antifuse structure in an integrated circuit, comprising:
a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;
a high-gas-saturatable layer at least partially within the chamber; and

a conductive, low-gas-saturatable layer between the high-gas-saturatable layer and the top of the chamber.

18. The antifuse structure of claim 17 wherein the high-gas-saturable layer has a hydrogen-gas-solubility at least 10 times greater than that of the conductive, low-gas-saturatable layer.

19. The antifuse structure of claim 17 wherein the chamber comprises:

a substrate; and

an insulative layer on the substrate and having an opening exposing a portion of the substrate, with the exposed portion of the substrate defining at least a portion of the bottom of the chamber and the opening defining the interior sidewalls of the chamber.

20. An antifuse structure in an integrated circuit, comprising:

a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;

a high-gas-saturatable layer at least partially within the chamber;

a conductive, low-gas-saturatable layer between the high-gas-saturatable layer and the top of the chamber; and

first and second conductive members overhanging the top of the chamber.

21. The antifuse structure of claim 20 wherein the high-gas-saturable layer has a hydrogen-gas-solubility at least five times greater than that of the conductive, low-gas-saturatable layer.

22. The antifuse structure of claim 20, wherein the high-gas-saturable layer comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium.

23. The antifuse structure of claim 20 wherein the chamber comprises:

a substrate; and

an insulative layer on the substrate and having an opening exposing a portion of the substrate, with the exposed portion of the substrate defining at least a portion of the bottom of the chamber and the opening defining the interior sidewalls of the chamber.

24. An antifuse structure in an integrated circuit, comprising:

a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;

a conductive layer within the chamber;

a layer within the chamber between the conductive layer and the bottom of the chamber, and comprising a material having a hydrogen-gas-solubility at least 10 times greater than that of at least a portion of the conductive layer; and

first and second conductive members overhanging the top of the chamber.

25. The antifuse structure of claim 24 wherein the chamber comprises:

a substrate; and

an insulative layer on the substrate and having an opening exposing a portion of the substrate, with the exposed portion of the substrate defining at least a portion of the bottom of the chamber and the opening defining the interior sidewalls of the chamber.

26. The antifuse structure of claim 24 wherein the first and second conductive members overhang the chamber by at least 250 angstroms.

27. The antifuse structure of claim 24, wherein the layer comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or hydride phases

28. The antifuse structure of claim 24, wherein the layer within the chamber comprises Pb_3O_4, PbO_2, HgO, Ag_2O, MnO_2, Ag_2O, K_3N, Rb_3N, $ReN_{0.43}$, Co_3N, Ni_3N, or Cd_3N_2.

29. The antifuse structure of claim 24, wherein the conductive layer comprises at least one of aluminum, copper, silver, and gold.

30. An antifuse structure in an integrated circuit, comprising:

a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;

a conductive layer within the chamber and comprising at least one of aluminum, copper, silver, and gold;

a layer lying within the chamber between the conductive layer and the bottom of the chamber, and comprising at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium, and hydrogen in solid solution or in one or more hydride phases or at least one of Pb_3O_4, PbO_2, HgO, Ag_2O, MnO_2, Ag_2O, K_3N, Rb_3N, $ReN_{0.43}$, Co_3N, Ni_3N, or Cd_3N_2; and

first and second conductive members each overhanging the top of the chamber by at least 250 angstroms.

31. The antifuse structure of claim 30 wherein the chamber comprises:
a substrate; and
an insulative layer on the substrate and having an opening exposing a portion of the substrate, with the exposed portion of the substrate defining at least a portion of the bottom of the chamber and the opening defining the interior sidewalls of the chamber.

32. An antifuse structure in an integrated circuit, comprising:
a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;
a conductive layer within the chamber and comprising at least one of aluminum, copper, silver, and gold; and
first and second conductive members each overhanging the top of the chamber by at least 250 angstroms.

33. The antifuse structure of claim 32 wherein the chamber comprises:
a substrate; and
an insulative layer on the substrate and having an opening exposing a portion of the substrate, with the exposed portion of the substrate defining at least a portion of the bottom of the chamber and the opening defining the interior sidewalls of the chamber.

34. An antifuse structure in an integrated circuit, comprising:
a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;
a conductive layer within the chamber and comprising at least one of aluminum, copper, silver, and gold; and

first and second conductive members each overhanging the top of the chamber by at least 250 angstroms and contacting the conductive layer within the chamber.

35. The antifuse structure of claim 34 wherein the first and second conductive members are fused to the conductive layer.

36. A structure for a programmable electrical connection in an integrated circuit, comprising:

a chamber having a bottom and a top and one or more interior walls extending between the top and bottom;

a conductive layer within the chamber; and

one or more conductive members, each overhanging the top of the chamber.

37. A programmable electrical connection comprising:

a layer having a cavity;

first and second conductive members having respective first and second ends overhanging the cavity;

a third conductive member in the cavity spaced from the first and second ends; and

means for displacing the third conductive member toward the first and second ends of the first and second conductive members.

38. The programmable electrical connection of claim 37 wherein the means for displacing the third conductive member toward the first and second ends includes a layer comprising a gas in solid solution or in a hydride phase or a layer comprising at least one of the following compounds: Pb_3O_4, PbO_2, HgO, Ag_2O, MnO_2, Ag_2O, K_3N, Rb_3N, $ReN_{0.43}$, Co_3N, Ni_3N, or Cd_3N_2.

39. A structure for a programmable electrical connection in an integrated circuit, comprising:

first and second conductive members; and

means for moving the second conductive member relative the first conductive member.

40. An integrated circuit comprising:

one or more transistors; and

one or more programmable electrical connections integral to the circuit and coupled to each of the one or more transistors, with each programmable electrical connection comprising:

at least a first and a second conductive member; and

means for moving the second conductive member relative the first conductive member.

41. The integrated circuit of claim 40, wherein the means for moving the second conductive member relative the first conductive member moves the second conductive member toward the first conductive member.

42. An integrated circuit comprising:

one or more transistors; and

one or more programmable electrical connections, with each coupled to at least one of the one or more transistors and comprising:

at least a first and a second conductive member; and

means for moving the second conductive member relative the first conductive member.

43. The integrated circuit of claim 42, wherein the means for moving the second conductive member relative the first conductive member moves the second conductive member toward the first conductive member.

44. A programmable logic array comprising:

one or more transistors; and

one or more programmable electrical connections coupled to each of the one or more transistors, with each programmable electrical connection comprising:

first and second conductive members; and

means for moving the second conductive member relative the first conductive member.

45. The integrated circuit of claim 44, wherein the means for moving the second conductive member relative the first conductive member moves the second conductive member toward the first conductive member.

46. An integrated memory circuit comprising:

one or more memory cells;

one or more redundant memory cells; and

one or more programmable electrical connections coupled to each of the one or more redundant memory cells, with each programmable electrical connection comprising:

first and second conductive members; and

means for moving the second conductive member relative the first conductive member.

47. A system comprising:

a processor; and

an integrated circuit, with the integrated circuit including one or more programmable electrical connections coupled to each of the one or more redundant memory cells, with each programmable electrical connection comprising:

first and second conductive members; and

means for moving the second conductive member relative the first conductive member.

48. A method of making an antifuse in an integrated-circuit assembly, the method comprising:

forming an opening in an insulative layer;

forming a metal layer in the opening;

forming a metal-oxide layer on the metal layer,

forming a conductive layer on the metal-oxide layer; and

forming at least one conductive member on the insulative layer which overhangs the opening.

49. The method of claim 48, wherein the metal layer in the opening comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium.

50. The method of claim 48, wherein the conductive layer comprises at least one of aluminum, gold, silver, and copper.

51. The method of claim 48, wherein the conductive member on the insulative layer overhangs the opening by at least 250 angstroms.

52. A method of making an antifuse in an integrated-circuit assembly, the method comprising:

a step for forming an opening in an insulative layer;

a step for forming a metal layer in the opening;

a step for forming a metal-oxide layer on the metal layer,

a step for forming a conductive layer on the metal-oxide layer; and

a step for forming at least one conductive member on the insulative layer which overhangs the opening.

53. The method of claim 52, wherein the metal layer in the opening comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium.

54. The method of claim 52, wherein the conductive layer comprises at least one of aluminum, gold, silver, and copper.

55. The method of claim 52, wherein the conductive member on the insulative layer overhangs the opening by at least 250 angstroms.

56. A method of making an antifuse in an integrated-circuit assembly, the method comprising:

forming an opening in an insulative layer;

forming a metal layer in the opening;

forming a metal-oxide layer on the metal layer,

forming a conductive layer on the metal-oxide layer;

forming at least one conductive member on the insulative layer which overhangs the opening; and

at least partially saturating the metal layer with a gas.

57. The method of claim 56, wherein the metal layer in the opening comprises at least one of titanium, hafnium, niobium, tantalum, thorium, vanadium, and zirconium.

58. The method of claim 56, wherein the conductive layer comprises at least one of aluminum, gold, silver, and copper.

59. The method of claim 56, wherein the conductive member on the insulative layer overhangs the opening by at least 250 angstroms.

60. A method of making an antifuse in an integrated-circuit assembly, the method comprising:

a step for forming an opening in an insulative layer;

a step for forming a metal layer in the opening;

a step for forming a metal-oxide layer on the metal layer,

a step for forming a conductive layer on the metal-oxide layer;

a step for forming at least one conductive member on the insulative layer which overhangs the opening; and

a step for at least partially saturating the metal layer with a gas.

61. A method of operating an antifuse in an integrated circuit, the method comprising:

at least partially saturating a portion of the antifuse with a gas; and

releasing gas from the saturated portion of the antifuse to program the antifuse.

62. A method of operating an antifuse in an integrated circuit, the method comprising:

a step for at least partially saturating a portion of the antifuse with a gas; and

a step for releasing gas from the saturated portion of the antifuse to program the antifuse.

63. A method of operating an antifuse in an integrated circuit, the method comprising:

at least partially saturating a first member of the antifuse with a gas; and

releasing gas from the first member; and

in response to releasing gas from the first member, moving a second member into contact with a third member.

64. The method of claim 63, wherein releasing gas from the first member comprises heating at least the first member.

65. A method of operating an antifuse in an integrated circuit, the method comprising:

a step for at least partially saturating a first part of the antifuse with a gas;

a step for releasing gas from the first member; and

a step for moving a second member into contact with a third member, in response to the step for releasing the gas.

66. A method of operating one or more antifuses in an integrated circuit, with each antifuse having a normally open electrical connection, the method comprising:

at least partially saturating a portion of one or more of the antifuses with a gas;

releasing gas from the saturated portions of one or more of the antifuses; and

in response to releasing gas from the saturated portions of the one or more of the antifuses, closing the normally open electrical connection of the one or more of the antifuses.

67. The method of claim 66, wherein at least partially saturating a portion of one or more of the antifuses with a gas comprises at least partially saturating a layer with hydrogen.

68. The method of claim 66, wherein releasing gas from the saturated portion of the one or more antifuses comprises heating the saturated portion.

69. A method of operating one or more programmable electrical connections in an integrated circuit, the method comprising:

at least partially saturating a portion of one or more of the programmable electrical connections with a gas;

releasing gas at a first rate from the saturated portions of one or more of the programmable electrical connections;

in response to releasing gas at the first rate from the saturated portions of the one or more of the programmable electrical connections, changing electrical status of the one or more of the programmable electrical connections; and

releasing gas at a second rate different from the first rate from the saturated portions of one or more of the antifuses.

70. A method of operating one or more programmable electrical connections in an integrated circuit, the method comprising:

a step for at least partially saturating a portion of one or more of the programmable electrical connections with a gas;

a step for releasing gas at a first rate from the saturated portions of one or more of the programmable electrical connections;

a step for changing electrical status of the one or more of the programmable electrical connections, in response to initiation of the step for releasing gas at the first rate from the saturated portions of the one or more of the programmable electrical connections; and

a step for releasing gas at a second rate different from the first rate from the saturated portions of one or more of the antifuses to disarm the one or more of the antifuses.

71. A method of operating a programmable electrical connection in an integrated circuit, the method comprising:

applying a voltage to a resistor;

heating a hydride, oxide, nitride, or carbonate compound in response to applying the voltage to the resistor;

releasing or evolving a gas from the hydride, oxide, nitride, or carbonate compound in response to heating; and

moving a first conductive element relative a second conductive element in responsive to releasing or evolving the gas.